NOTE: This draft, dated 15 May 2009 prepared by the Naval Air Systems Command, has not been approved and is subject to modification. DO NOT USE PRIOR TO APPROVAL. (Project 5995-2009-001)

INCH-POUND

MIL-DTL-22442G
DRAFT
SUPERSEDING
MIL-C-22442F
1 April 2000

DETAIL SPECIFICATION

CABLE ASSEMBLIES, AIRCRAFT AUDIO, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for complete cable assemblies, with molded or attached plugs including any required built-in electronics, used in aircraft intracommunications and intercommunications systems. It covers cord sets for personal gear such as microphones, headsets, earphones, hand sets and similar equipment, and cable assemblies for contact with ground crew personnel.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 4L8000B120-3, Highway 547, Lakehurst, N.J., 08733-5100, or mailto:michael.sikora@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-228	-	Cable and Wire, Insulated, Methods of Testing.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-J-641/22	-	Jack, Telephone U-385/U.
MIL-P-642/14	-	Plug, Telephone (Type U-384/U) 5 Conductor Single.
MIL-C-26482	-	Connectors, Electrical (Circular, Miniature, Quick Disconnect, Environmental Resisting), Receptacles and Plugs, General Specification for.
MIL-C-39029	-	Contacts, Electrical Connector, General Specification for.

(See ASSIST database for list of specification sheets.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202	-	Electronic and Electrical Components, Parts, Test Methods for.
MIL-STD-810	-	Environmental Test Methods and Engineering Guide Lines.
MIL-STD-889	-	Dissimilar Metals.

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-454	-	Electronic Equipment, General Guidelines for.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA. 19111-5094)

2.2.2 Other Government documents, drawings and publications. The following other Government documents, drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEFENSE STANDARDIZATION PROGRAM OFFICE

SD-6	-	Provisions Governing Qualification

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA. 19111-5094)

2.3 Non-Government publications. The following documents forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-D1149	-	Standard Test Method for Rubber Deterioration -Surface Ozone Cracking in a chamber.

(Copies of this document are available from http://www.astm.org or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA. 19428-2959.)

UNDERWRITERS LABORATORY, INC. (UL)

UL-1581	-	UL Standard for Safety Electrical Wires, Cables, and Flexible.

(Copies of this document are available from http://www.ul.com/ or Underwriters Laboratory, Inc., Publications Stock, 333 Pfingsten Road, North Brook, IL 60062.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

J-STD-001	-	Requirements for Soldering Electrical and Electronic Assemblies.

(Copies of this document are available from http://www.ansi.org/ or American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

IPC-2221 - Generic Standard for Printed Board Design.

IPC-2222 - Sectional Design Standard for Rigid Organic Printed Boards.

(Copies of these document are available from http://www.ipc.org/or Association Connecting Electronics Industries, 3000 Lakeside Drive, Bannockburn, IL 60015)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this document and the specification sheets, the latter shall govern.

3.2 Part or identifying numbers (PIN). Part numbers for cable assemblies furnished under this specification shall be constructed as shown in 6.6.

3.3 Qualification. Cable assemblies furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.3.1 Qualification of individual components is not required as noted on individual specifications sheets. However the Government reserves the right to require certification of compliance of the same. Production items shall be identical in all respects to those submitted to the Government for approval, unless otherwise approved by the Government in writing.

3.3.2 Qualification by similarity. Cable assemblies furnished under this specification may be qualified by similarity as shown by the examples in MIL-DTL-22442/6.

3.4 Design and construction.

3.4.1 Connectors. The connectors shall be as specified in the detailed specification sheets.

3.4.1.1 Contacts. Contacts used in MIL-C-26482 or equivalent type circular connectors approved by the qualifying activity shall conform to MIL-C-39029. Other contacts shall be as specified in the specification sheet.

3.4.2 Connections. Connections shall be as specified in the specification sheet.

3.4.3 Termination's. Termination's shall conform as specified in specification sheet.

3.4.4 Cable/cord. Cable/cord shall be as specified in the specification sheet. Cable sizing, configuration, and number of conductors shall also be as specified in the specification sheet. Flame retarding polyurethane may be used. Regarding the conductor insulation, alternative materials compatible with the outer jacket material may be used.

3.4.4.1 Molded materials. Molded materials shall be made from similar materials as the cordage jacketing materials, and shall provide a bond that will meet the requirements of 3.5.5, 3.5.6, 3.5.8, and 3.5.10 with the cable jacket.

3.4.5 Extended length. Extended length of the cable assembly shall be as specified in the specification sheet.

3.4.6 Weight. The maximum weight of the cable assembly shall be as specified in the specification sheet.

3.4.7 Switch assemblies. Each switch assembly housing shall be built in accordance with the specification sheet and may contain a microphone amplifier, microphone keying switch, earphone impedance matching transformer, and terminal block, or any combination thereof, as specified in the specification sheet.

3.4.8 Switches. Switches shall be as specified in the specification sheet.

3.4.9 Terminal blocks. Terminal blocks shall be as specified in the specification sheet.

3.4.10 Other non-ferrous metals and alloys. The plating or finish used for each individual part shall provide a good appearance, corrosion and deterioration resistance for that part. Various problems such as soldering, fitting, assembly, reaction with adjacent parts and the like, shall be considered in the selection of the plating or finish.

3.4.11 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-889. The use of dissimilar metals shall be limited to applications where similar metals cannot be used due to peculiar design requirements.

3.4.12 Interchangeability. Interchangeability shall exist between all units and replaceable assemblies, subassemblies, and parts for all equipment delivered on the contract using MIL-HDBK-454, Guideline 7 as guidance. Production items shall be identical in all respects to those submitted to the Government for approval, unless otherwise approved by the Government in writing.

3.4.13 Marking. Cable assemblies shall be marked on plastic bands, or heat shrinkable tubing, and shall fit snugly around the cable circumference, more than one identification band may be used. Heat shrinkable tubing when used shall not be used as support or as a part of the cable. The cable assemblies shall be marked with the following information:

Information Required	Example
Contract Number	****
Military P/N (Type Designator)	M22442/XX-X (CX-XXXX)
Contractor and Government Entities (Cage)	****
NSN	NSN 5995-***

3.4.14 Color. The cable shall be black.

3.4.15 Clothing clip. The clothing clip shall be as specified in the specification sheet.

3.4.16 Insulating and impregnating compounds. All insulating and impregnating compounds including varnishes and waxes, shall meet the requirements for each application as specified, under all service conditions, including test conditions outlined in section 4 of this specification. The compound shall preserve the dielectric strength of the insulation to which it is applied. A compound shall not, either in the state of its original application or as a result of aging under severe service conditions, show any injurious effect upon the insulation it is designed to protect, and shall not cause corrosion or deterioration of adjacent metal or plastic parts.

3.4.17 Cementing compounds. Any cementing compound used in the construction of the cable assembly shall withstand all service conditions including test conditions outlined in section 4 of this specification without evidence of loosening or otherwise affecting the performance requirements of the cable assembly.

3.4.18 Soldering. Cable assemblies shall be soldered in accordance with J-STD-001, class 3.

3.4.19 Printed wiring boards. Printed wiring boards shall be designed in accordance with IPC-2221 and IPC-2222.

3.5 Performance. The cable assembly shall meet the following performance requirements when applicable.

3.5.1 Continuity. Each conductor shall be continuous in the assembly through the termination's of the conductors, where the design calls for a continuous line. Testing shall be in accordance with 4.5.3.

3.5.2 Dielectric withstanding voltage. Unless otherwise specified in the specification sheet the cable assemblies shall be capable of withstanding a dielectric withstanding voltage as specified in the applicable cordage specification for a minimum of 30 seconds when tested in accordance with 4.5.4.

3.5.3 Gauging. For connector terminated cable assemblies, contacts and interfacial dimensions shall not be changed by the assembly procedure to prevent intermating of connectors. Testing shall be in accordance with 4.5.5.

3.5.4 Pull and twist. The terminal components including metallic terminals, taper pins, connectors, terminal blocks, and molded bend relief's shall not part from the conductor at the specified loads in accordance with the applicable drawings or specification sheets. After twisting and pulling in accordance with 4.5.6, there shall be no more than 1/32 inch slippage of the cable jacket from the connector, nor separation of the bond on molded termination's, molded bend relief's, and molded strain relief's.

3.5.5 Bend relief, "Y" junction/crotch flexibility (see 6.5). For flexible molded cable assemblies with bend relief's, or "Y" junction/crotch's there shall be no electrical discontinuity, bond separation, or cracking between the insulation or bend relief and the cable jacket after being tested in accordance with 4.5.7 or 4.5.7.1. The test specified in 4.5.7.1 is required only for cable assemblies that are spliced at the "Y" junction/crotch.

3.5.6 Low temperature flexibility. For cable assemblies with molded or heat-shrunken components, the insulation of each conductor within a portion of the cable jacket containing a molded or potted splice, crotch, or other molded or potted section or heat-shrunken transition (see 6.5), shall be tested for low temperature flexibility. The condition of the test temperature shall be the lower limit of the cable operating temperature range. If not specified, the temperature shall be –40 °F. After test, there shall be no visible cracks or other damage in the molded section or adjacent portion of the cable jacket, and the assembly shall meet the specified performance. Testing shall be in accordance with 4.5.8.

3.5.7 Durability. The cable connectors shall exhibit a contact resistance and maximum mating force or torque as specified in accordance with the applicable drawings or specifications sheets. After the cable assembly and connector have been subjected to the durability test in accordance with 4.5.9, connectors and cable assemblies shall not show signs of degradation of engagement or separation forces, wear of contact plating or coupling mechanisms when tested as specified herein or in the applicable drawings or specifications.

3.5.8 Ozone resistance. Cable assemblies shall be tested for ozone resistance in accordance with 4.5.10. At the completion of the exposure period, there shall be no evidence of cracking when examined under 7X magnification.

3.5.9 Jacket elongation. Cable assemblies shall be tested for jacket elongation. Testing shall be in accordance with 4.5.11. The test requirement shall be governed by the applicable cable jacketing specification for the section under test. The cable jacketing specification shall be as specified in the applicable MIL-DTL-22442 specification sheet. If no elongation requirements are given, the requirement shall be 175 percent minimum.

3.5.10 Durometer hardness. The molded assemblies shall have a durometer hardness of 70 ± 20 Shore A units for both rubber and polyurethane when tested in accordance with 4.5.12. This shall apply to all molded termination's and other molded sections.

3.5.11 Material reversion (polyurethane and polyacrylic compounds only). Molding, potting, insulating, or jacketing compounds shall not crack, run, drip, or deform, and the hardness after conditioning shall be no more than 10 points below the durometer hardness Shore "A" measured by 3.5.l0; for polyurethane compounds cured with non-carcinogenic agents, the change shall be no more than 15 points below.

3.6 Environmental.

3.6.1 Temperature - altitude. Cable assemblies with electronic components shall meet the performance requirements of the applicable specification sheet during and after the temperature-altitude test of 4.6.1. The cable assembly shall be operational when specified by MIL-STD-810. The steps performed shall be in the sequence specified in 4.6.1.

3.6.2 Salt fog. After completion of the salt fog test of 4.6.2, the cable assemblies shall show no evidence of corrosion and shall meet all operational requirements at the end of the 48 hour drying period specified in MIL-STD-810, Method 509.

3.6.3 Flammability. The cable assembly shall pass the flammability tests as specified in 4.6.3.

3.6.4 Vibration. All cable assemblies that contain connectors, when in use, are hard-mounted to the aircraft, shall meet the requirements of 3.5.1 while tested in accordance with 4.6.4. Only the connector and a section of its associated cable need be tested.

3.6.5 Environmental service conditions. Each cable assembly shall meet the specified performance requirements of the applicable specification sheet and continuity requirements of 3.5.1, within one hour of being subjected to the following environmental tests of 4.6:

a. Humidity (see 4.6.5).

b. Thermal shock (see 4.6.6).

The cable jacketing shall show no signs of cracking after completion of the thermal shock test when examined under 7X magnification.

3.7 Workmanship. The cables shall be uniform in quality and shall be free from defects. Cleaning should be in accordance with MIL-HDBK-454, Guideline 9. There shall be no evidence of loose electrical connectors, poor or improper molding or fabrication, damaged or improperly assembled contacts, peeling; flaking or chipping of plating or finish, mechanical damage due to testing environment, nicks or burrs of metal parts of surfaces, improper or incorrect marking; or improper tinning of solder cups, terminals, pins, or contacts.

4. VERIFICATION

4.1 The text of this paragraph has been deleted. The paragraph number is retained in order to maintain the numbering sequence for inspections and tests that are referenced in the tables of many specification sheets listed in supplement 1 to this document.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Qualification inspection. Qualification inspection shall be performed in accordance with the provisions of SD-6. The qualification inspection shall consist of all Group I tests specified in table I of the specification sheet for each cable assembly. The qualification inspection sample shall consist of fifteen units of each cable assembly for which qualification is desired. At least two of the fifteen units shall be considered control samples, and only Group IA tests shall be performed on these units until the event of a failure. Group IA inspections shall be performed on each of the fifteen sample items. At least two samples shall be submitted to each of the Group I (B, C, and D) inspections. In the event of a single failure, one of the control samples shall be submitted to the failed test sequence. If a second failure occurs, qualification shall be denied.

4.3.1 Qualification samples. Items for qualification must be separately packaged and forwarded to the activity responsible for qualification as designated in the letter of authorization. The sample shall in all respects be representative of the manufacturer's production item. Each of the items shall be subjected to the applicable inspections specified in Group I of table I of the specification sheet. Samples shall be marked in accordance with 3.4.13 except the items shall also be marked (Qualification Samples) and shall include the applicable specification number, and shall reference the letter authorizing the tests.

4.3.1.1 Retention of qualification. The activity responsible for requalifying cables to this specification shall specify what tests are required.

4.3.2 Acceptance of final product. Acceptance or approval of material during course of manufacture shall in no case be construed as a guarantee of the acceptance of the finished product. Acceptance of the finished product shall be upon a lot basis after satisfactory completion of all required tests. Acceptance tests shall consist of Group II and Group III tests in table I of the specification sheet for the specified cable assembly.

4.4 Quality conformance inspection. Quality conformance inspection for this specification shall consist of the tests of Group II and Group III of the specification sheet unless otherwise specified in the contract or purchase order. Group II quality conformance tests shall be performed on each individual unit prior to acceptance. Units failing the quality conformance test may be discarded or reworked to correct defects and resubmitted for acceptance. The contractor is responsible for the performance of all inspection requirements as specified in the contract and this specification.

4.4.1 Production lot sampling. All cable assemblies submitted for inspection as a production lot shall be manufactured using identical components, raw materials and processes. All cordage and molding material shall be from the same incoming lots. All other components of identical type designation shall be procured from the same manufacturer for all cable assemblies in the production lot (the manufacturer shall not change cordage manufacturers, or connector manufacturers, etc., during a production lot). All Group III tests specified in table I of the specification sheet shall be performed on sample units pulled from the production lot which has already passed the Group II inspection. The sample units shall be chosen at random under the supervision of the cognizant government inspector. Sample sizes for Group III sample testing as specified in table I of the specification sheet shall be in accordance with table I of the general specification. Contracts for less than 10 cables shall be subjected to 100 percent inspection of Group A tests. Distribution of test samples between Groups B and C shall be in accordance with the test plan prepared by the contractor and approved by the cognizant government inspector. All components submitted by a manufacturer as a single production lot using identical components as noted above shall be tested as a single production lot regardless of how many shipment lots the production lot is divided into.

TABLE I. - Sample plan for Group III sample testing.

Number of Cable Assemblies in Contract	Total Number of Cable Assemblies to be Tested
10 through 280	3
281 through 500	6
501 through 1000	9
1001 through 2000	12
2001 through 5000	15
5001 or more	18

4.4.1.1 Disposition of samples. Samples subjected to Group B tests may be shipped under the contract. Samples subjected to Group C tests shall not be shipped under the contract.

4.4.1.2 Noncompliance. No failures shall be allowed in Group III inspection. If a sample unit fails to pass Group III inspection, the supplier shall take corrective action on the material or process or both, as warranted, and on all units of production that can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action has been taken. Group III inspection shall be repeated on additional sample units (all inspections or the inspection that the original sample failed, at the option of the Government). Group II inspection may be reinstituted, however, final acceptance shall be withheld until the Group III reinspection has shown that the corrective action was successful. In the event of a failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the qualifying activity.

4.4.2 Contractors not having laboratory testing facilities satisfactory to the Government for sampling tests shall engage the services of a commercial testing laboratory acceptable to the Naval Air Warfare Center, Aircraft Division (NAWCAD) Detachment, Indianapolis, IN 46219-2189.

4.5 Methods of Inspection.

4.5.1 Test conditions. Unless otherwise specified herein or in the equipment specification, measurements and tests shall be made at ambient conditions.

4.5.2 Visual and mechanical examinations. The cable assemblies shall be examined to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements.

4.5.2.1 Soldering. All soldering shall meet the general purpose soldering requirements of J-STD-001, class 3.

4.5.3 Continuity. dc resistance checks shall be made in accordance with the specification sheet. This shall include continuity across wire terminal junctions. All conductors terminating in active components shall be tested before the active component is included in the circuit.

4.5.4 Dielectric withstanding voltage. Dielectric strength shall be performed in accordance with MIL-STD-202, Method 301. The potential and time duration shall be as specified in the applicable cordage specification. The potential shall be applied between each conductor and the remaining conductors connected together and to the shield, and metallic shells, if present. All conductors terminating in active components shall be tested before the active component is included in the circuit.

4.5.5 Gauging. Contact locations and interfacial dimensions of the connector as specified in the applicable connector specification or drawing, shall be measured after assembling connector to cable. Certified test data from the connector manufacturer may be used in lieu of final assembly gauging. It is mandatory that the cable manufacturer perform gauging on the molded rubber connector (M22442/2-l and M22442/2-2).

4.5.6 Pull and twist test. The cable assembly pull test shall consist of the twist test (4.5.6.1) followed by the pull test (4.5.6.2).

4.5.6.1 Twist test. The twist test shall be applicable to all ends of the cable assembly that are terminated with a connector only. Each connector shall be secured in a holding device in such away that it cannot rotate. The twist shall be applied about the axis of the cable to cause a point on the cable three inches from the connector to twist 180 degrees from the starting position and be held there for 30 seconds. The cable shall then be twisted in the opposite direction such that the point on the cable has twisted 180 degrees past the original starting position, and be held there for 30 seconds.

4.5.6.2 Pull test. The pull test shall be applied to all terminals, connectors, switch assemblies, and taper pins. The component of the cable assembly to be tested shall be secured in a stationary holding device and the cable gripped six to twelve inches from the component of the cable assembly under test. If the cable assembly is too short to grip six to twelve inches from the component it may be gripped closer. The grips shall not slip or damage the cable during the test. The static force shall be applied for 30 seconds with the force values specified as follows.

4.5.6.2.1 Terminals. Terminals soldered to circular conductors shall be subjected to 5 pounds minimum pull. Terminals crimped to circular conductors shall be subjected to 3 pounds minimum pull. Contacts as part of the connector shall not be considered a terminal.

4.5.6.2.2 Taper-pins. Taper-pins inserted into a connector shall be subjected to a pull of 3 pounds minimum at the taper-pin connector connection.

4.5.6.2.3 Connectors. A pull force of 20 ± 2 pounds shall be applied. If the connector is potted or molded 30 ± 2 pounds shall be applied.

4.5.6.2.4 Switch assembly. The switch assembly shall be securely mounted and a 20 ±2 lb. force shall be applied to the connecting cables. The cable assembly shall meet the requirements of 3.5.4.

4.5.7 Bend relief flexibility. Each bend-relief in the cable assembly shall be manually subjected to 30 continuous flexure cycles, at room temperature, through a 180 degree arc, at approximately 30 cycles per minute. Each bend relief shall be held in a mechanical device so that the portion of the cable entering the bend relief flexes when the cable is flexed. The bend-relief is free to flex with the cable in one direction through 90 degrees from the axially in-line starting position, back to the starting position, then through 90 degrees in the opposite direction, and return to the starting position. The flexing procedure shall be repeated for 30 cycles in a plane 90 degrees axially to the plane of initial flexing.

4.5.7.1 "Y" junction/crotch flexibility. Each cable assembly that contains a "Y" junction/crotch shall be tested for flexibility and continuity as follows:

a. Cable assemblies shall be clamped and suspended in the vertical position with the "Y" junction/crotch securely clamped at the flexure point and will not turn or twist during flexing. figure 1 is a typical test set up.

b. A one pound weight shall be attached to each leg of the "Y" junction/crotch. The legs shall be positioned so that they are spread open 60 degrees, 30 degrees either side of vertical.

c. The cable assembly shall be rotated about the longitudinal axis through the point were the legs emerge from the fixture. The fixture shall be rotated through an angle of 120 degrees, 60 degrees either side of vertical at a flexing rate of 85 cycles per minute for 25,000 cycles without electrical discontinuity. After completion of this test the cable assembly shall meet the requirements of 3.5.1 and 4.5.3. The "Y" junction/crotch shall be then cut open an inspected for compliance with 3.4.18 and 4.4.2.1.

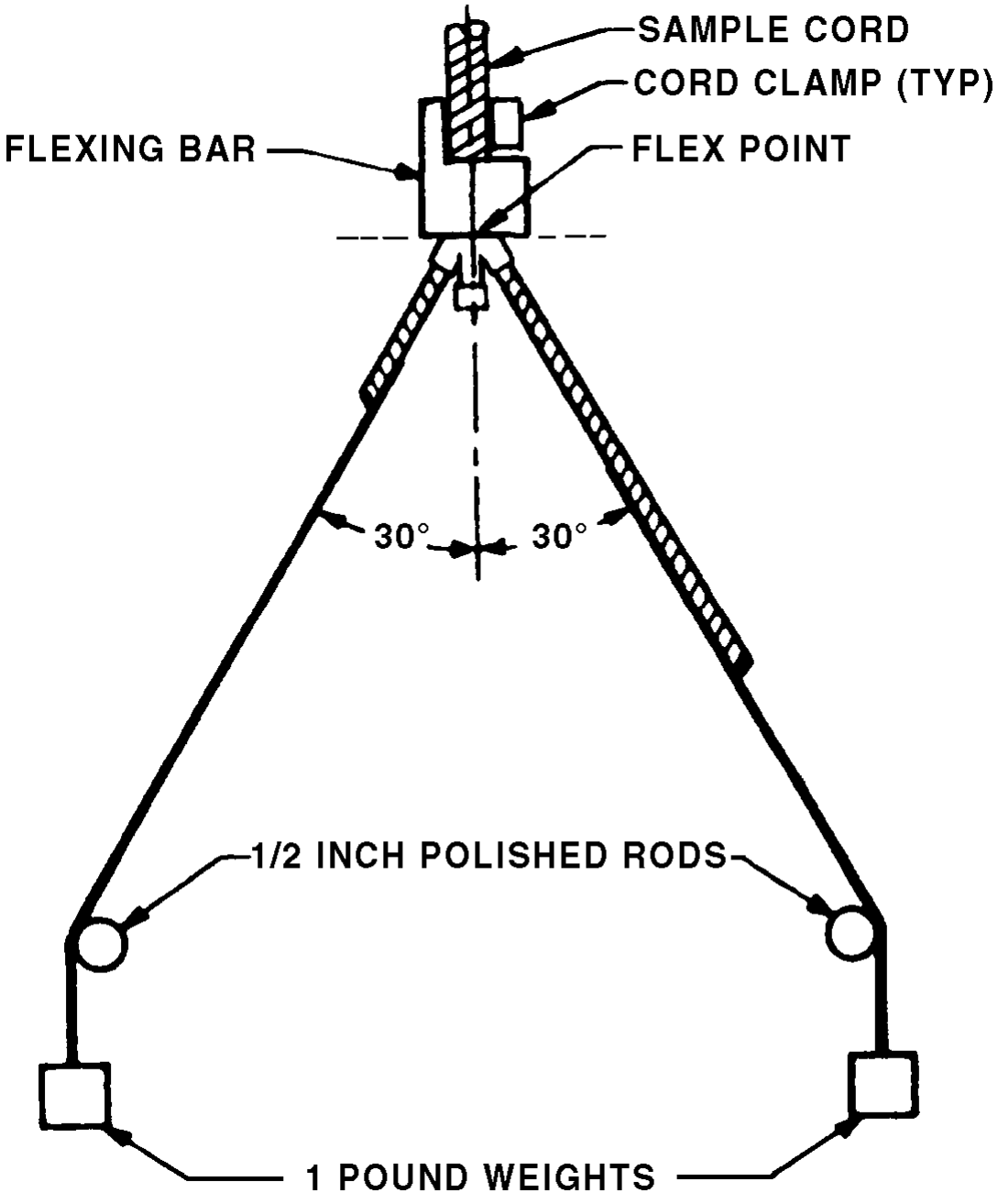


FIGURE 1. "Y" junction/crotch flex test fixture typical.

4.5.8 Low temperature flexibility. The cable assembly or portion thereof containing a "Y" junction/crotch or molded section (see 6.5 g) or heat-shrunken transition (see 6.5 d, e, and f) shall be aged in a circulating air oven for a minimum of 48 hours at 160 ±2 °F. The cable assembly shall then be conditioned for a minimum of 8 hours at the temperature specified in 3.5.6. This temperature shall be continuously recorded during conditioning and testing. Each crotch or molded section (see 6.5 d & g) shall be held in a mechanical device so that the portion of the cable entering a "Y" junction/crotch or molded section flexes when the cable is flexed. The cable shall be flexed mechanically. Any part of a mechanical device which will be in contact with the test specimen shall be cold conditioned. At the end of the conditioning period and while at the conditioning temperature, the cable shall be flexed rapidly for 30 cycles through a 180-degree arc (± 90 degrees from 0 degrees). The flexing procedure shall be repeated in a plane 90 degrees to the plane of initial flexing. At the conclusion of the test, the specimen shall be examined visually at room temperature under 3X magnification and electrically tested for conductor continuity.

4.5.9 Durability. Unless otherwise specified in the connector specification sheet all connectors of the cable assembly shall be mated and unmated 100 times. MIL-C-26482 or equivalent type connectors (as approved by the qualifying activity) shall be mated manually or automatically at a rate not to exceed 12 cycles per minute, and shall be torqued to the value specified in the applicable MIL-C-26482 specification sheet. Quick disconnect connectors shall be unmated by breaking the connectors in a direction perpendicular to the axial plane and major axis. All other connector types shall be mated and unmated in the axial direction, at a rate not to exceed 12 cycles per minute.

4.5.10 Ozone resistance. The cable assembly shall be tested for ozone resistance in accordance with ASTM-D1149 with the following test conditions: Test time shall be 168 ± l hour, ozone concentration shall be 50 parts per 100,000,000, and the chamber temperature shall be 100 ± 5 °F. Any bend relief or a cordage intersecting a molded junction shall be bent at an angle of 90 degrees over the mandrel while in the chamber. In addition, the cable jacket shall be wrapped around the mandrel. The mandrel radius shall be based on the cross sectional area of the bend relief or a cordage intersecting a molded junction.

Specimen Cross Section	Mandrel Radius
Up to 0.500	4 X Cross Section
0.501 to 0.750	5 X Cross Section
0.751 to 1.250	6 X Cross Section

4.5.11 Jacket elongation. The elongation test shall be in accordance with FED-STD-228, Method 3031.

4.5.12 Durometer hardness. Durometer hardness shall be measured by use of a durometer hardness gauge acceptable to the government inspector. The tolerance shall be ± 20 Shore A units. Tests may be performed on molded slabs 0.250 inch thick.

4.5.13 Material reversion. The molding, potting, and insulating material shall be tested using specimens approximately 4 inches square by 1/8 inch thick, the specimens for jacketing material shall be 6.5 inches long for a Durometer Hardness Shore A. Then, they shall be placed in a chamber maintained at 212 ±l°F and 95 ± 2 percent relative humidity without condensation for 28 days. The cable assemblies shall be arranged so they do not come in contact with each other nor with the chamber walls or floor. After conditioning, the cable assemblies shall meet the requirements of 3.5.11.

4.6 Environmental service condition tests. The cable assemblies shall meet all specified performance requirements when tested in accordance with the following procedures.

4.6.1 Temperature-altitude (only applicable to assemblies with active components or transformers). The cable assembly shall be tested in accordance with MIL-STD-810, Method 520, Procedure III, except that humidity and vibration environments shall be deleted. Delete steps 2 through 7 and substitute the following:

Step 2. With the cable assembly nonoperating, adjust the chamber test conditions to –62 °C and ambient pressure. The temperature shall be stabilized and maintained for at least two hours.

Step 3. With the cable assembly nonoperating, adjust the chamber temperature to -65.2 °F and the altitude to 50,000 feet.

Step 4. With the cable assembly nonoperating, adjust the chamber test conditions to –14 °F and ambient pressure. After the temperature has stabilized, the chamber door shall be opened and the frost permitted to form on the cable assembly. The door shall remain open long enough for the frost to melt, but not long enough to allow the moisture to evaporate.

Step 5. With the cable assembly nonoperating, adjust the chamber test conditions to +185° C and ambient pressure. The chamber temperature shall be stabilized and maintained for at least 16 hours.

4.6.2 Salt Fog. The cable assembly shall be tested in accordance with MIL-STD-810, Method 509.

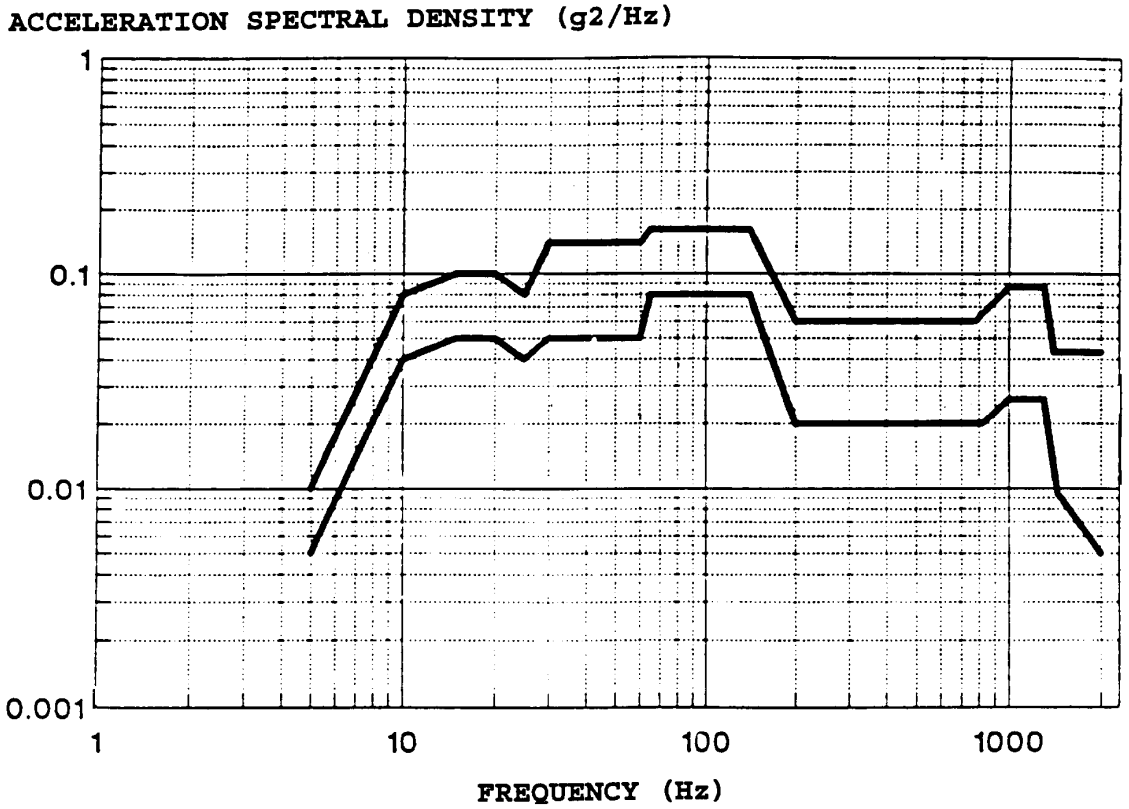
4.6.3 Flammability. The cable assembly shall be tested in accordance with the vertical flame test of UL-158l.

4.6.4 Vibration. The cable assembly shall be tested in accordance with MIL-STD-810, Method 514, Category 5, Procedure I.

4.6.4.1 Vibration Fixtures. Vibration fixtures, if used, shall be designed to transmit the required vibration to the test specimen with minimum attenuation, amplification or distortion. Provisions shall be made for attachment of monitor transducers as necessary to maintain vibration tolerances within the limits specified in MIL-STD-810, Method 514, Category 5, Procedure I. Transducers shall be located as close to the test item mounting locations as possible. Any structural resonance in the test fixture, if within 20 percent of a resonant frequency, shall be adjusted such that vibration amplitudes at all mounting points are within ±25 percent of the arithmetic average of the amplitudes at all these points. This average shall be used to establish the test level.

4.6.4.2 Functional Vibration. Functional vibration testing of the cable assembly in accordance with figure 1 shall be performed for each of the three orthogonal axes both prior to and following the endurance vibration test. The cable assembly shall be continuity tested (see 4.5.3) during functional vibration testing and shall meet all requirements of the specification during and after both portions of the functional vibration test.

4.6.4.3 Endurance Vibration. Endurance vibration testing shall consist of random vibration for each of the three orthogonal axes in accordance with figure 2. The cable assembly shall meet all performance requirements of this specification following the test.



ONE HALF HOUR FUNCTIONAL LEVEL FOLLOWED BY ONE HOUR ENDURANCE LEVEL FOLLOWED BY ONE HALF HOUR FUNCTIONAL LEVEL IN EACH OF THREE MUTUALLY PERPENDICULAR AXIS					
Frequency (Hz)	Functional Level (g^2/Hz)	Endurance Level (g^2/Hz)	Frequency (Hz)	Functional Level (g^2/Hz)	Endurance Level (g^2/Hz)
5	.005	.01	140	.08	.16
10	.04	.08	200	.02	.06
15	.05	.10	775	- -	.06
20	.05	.10	825	.02	- -
25	.04	.08	1000	.026	.087
30	.05	.14	1300	.026	.087
60	.05	.14	1400	.01	.043
65	.08	.16	2000	.005	.043
FUNCTIONAL LEVEL 6.45 grams			ENDURANCE LEVEL 12.0 grams		

FIGURE 2. Functional and endurance vibration levels.

4.6.5 Humidity. The unit shall be tested in accordance MIL- STD-810, Method 507, except as follows:

a. Step 2. The chamber temperature shall be 160 °F.

b. Step 4. Maintain 85 percent or greater relative humidity and reduce internal chamber temperature in 16 hours to 83 ±10 °F.

c. Step 5. Delete.

d. Step 6. Repeat steps 2, 3, and 4 for a total of 10 cycles (not less than 240 hours).

e. Step 7. The cable assembly shall be operated within one hour following completion of the 10th cycle, and shall be tested to verify compliance with operational requirements.

4.6.6. Thermal shock. The non-operating cable assembly shall meet all operational requirements when subjected to thermal shock in accordance with MIL-STD-810, Method 503, Procedure II. For step 1, low temperature shall be –25 °F. For step 2, high temperature shall be +160 °F. The unit shall be cycled through three cycles of low and high temperature.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the military department's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The cable assemblies covered by this specification are intended for use in military aircraft. They are military unique because they have to connect existing military communication sets with the pilots earphones and microphones. There are no commercial equivalents or applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.

b. Applicable specification sheet number, title, and date (see 3.1).

c. Applicable specification sheet part number (see 3.1).

d. Accessories, when they are desired to be furnished with the cable assemblies.

e. Number of cable assemblies required.

f. Packaging requirements (see 5.1).

g. Responsibility for inspection, if other than specified (see 4.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract qualified for inclusion in Qualified Products List QPL No 22442 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification Information pertaining to qualification of products may be obtained from the Commanding Officer Naval Air Warfare Center, Aircraft Division, Detachment Indianapolis Code 11X348C 6000 E. 21st Street Indianapolis, IN 46219-2189. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at http://assist.daps.dla.mil.

6.4 Rationale. The following historical documentation provides rationale for various requirements in this specification.

6.4.1 Test equipment. The test equipment described in 6.4.1.1 through 6.4.1.9 was selected to minimize testing problems encountered in measuring low level AC true RMS voltages and impedance. The low level ac microvoltages are several orders of magnitude lower in value than

the thermally induced voltages. The low level impedance's are equivalent to short circuits for some instruments and thereby create test induced measurement errors. Although automated test equipment is permitted and encouraged, be aware of test induced problems created by various analogue to digital conversion techniques. These test induced problems include the generation of nonexistent failures as well as the concealment of bonafide failures.

6.4.1.1 Multimeter.

a. Digital readout (4-1/2 digits).

b. Direct current (dc) and true RMS alternating current (ac).

c. Ranges: 10 microvolts to 15 volts RMS ac, l to 30 volts dc l/.

d. Accuracy: ±.5 percent.

e. Input impedance: l megohm minimum.

f. Inputs isolated from ground up to 30 volts.

1/ NOTE: A calibrated lock-in amplifier with fixed incremental gain control may be used as a true RMS ac voltmeter provided all other requirements are met. A range of 10 millivolts to 15 volts is acceptable providing the attenuator maintains calibration under varying loads over the frequency range.

6.4.1.2 Signal or function generator.

a. Sine wave output.

b. Frequency range: 100 to 6000 Hz minimum.

c. Frequency accuracy and flatness at full output: ±2 percent.

d. Harmonic distortion: Less than -65 dB (relative to fundamental) at full output for each frequency.

e. dc offset: 1 Millivolts maximum.

f. Voltage range: 1 Millivolts to 15 volts 2/.

g. Output isolated from ground up to 30 volts.

2/ NOTE: An amplifier may be used providing the function generator plus amplifier combination meets the above specifications.

6.4.1.3 Spectrum analyzer (optional).

a. Frequency range: 100 to 6000 Hz.

b. Center frequency accuracy: ±.003 percent.

c. Bandwidth: 1 Hz minimum to 500 Hz maximum.

d. Measurement ranges: l microvolts to 15 volts linear, -120 dBV to +30 dBV log.

e. Dynamic range: 70 dB.

f. Voltage accuracy: ±0.5 dB.

g. Input impedance: 1 megohm minimum.

h. Inputs isolated from ground up to 30 volts.

6.4.1.4 Distortion analyzer.

a. Frequency range: 100 to 6000 Hz.

b. Frequency accuracy: ±2 percent.

c. Measurement range: 30 microvolts to 15 volts.

d. Dynamic range: 70 dB.

e. Voltage accuracy: ±2 percent.

f. Input impedance: 0.1 megohm minimum.

g. Fundamental rejection: 70 dB.

h. Inputs isolated from ground up to 30 volts.

6.4.1.5 Precision decade resistance box.

a. Frequency range: dc to 6000 Hz.
b. Resistance range: 2 to 15 ohms.

c. Resistance increments: 0.1 ohms.

d. Accuracy: 0.5 percent.

e. Resistance zero setting: 12 milliohms or less.

f. Inductance: Less than 0.03 microhenries.

g. Capacitance: Less than 8 picofarads.

h. Low temperature and power coefficients.

6.4.1.6 Lock-in amplifier (optional).

a. Frequency range: 100 to 6000 Hz.

b. Sensitivity: l microvolts to 0.5 volts.

c. Output time constants: l millisecond to 10 seconds.

d. Harmonic rejection: 55 dB.

e. Normal output stability: 50 ppm.

f. Gain accuracy: ±2 percent.

g. Digital readout (3-1/2 digits).

h. Phasing: Automatic.

i. Input impedance: l megohm or greater.

j. Gain: Incremental or lockable after calibration.

6.4.1.7 Oscilloscope.

a. Channel: Single.

b. Bandwidth: 5 megahertz.

c. Time base: 20 microsec/div to 1 millisec/div.

d. Time base accuracy: ±3 percent.

e. Coupling: ac and dc.

f. Source: Internal.

g. Sweep mode: Auto trigger.

h. Voltage base: 5 millivolts/div to 10 volts/div.

i. Voltage base accuracy: ±3 percent.

j. Input impedance: l megohm minimum.

6.4.1.8 Ac Power Supply (optional).

a. Sine wave output.

b. Frequency range: 100 to 6,000 Hz minimum.

c. Frequency accuracy and flatness at full output: ±2 percent.

d. Harmonic distortion: Less than -65 dB (relative to fundamental) at full output for each frequency.

e. dc offset: 1 Millivolts maximum.

f. Voltage range: l Millivolts to 15 volts.

g. Output power: 220 VA with continuous volt-ampere output even under zero or unity power factor loads.

h. Output isolated from ground up to 30 volts.

6.4.1.9. AC ratio transformer standard.

a. Ratio: 1.111111 maximum, 0.0111111 minimum.

b. Frequency range: 50 Hz to 10 KHz.

c. Terminal linearity: 0.0001 percent (l ppm).

d. Resolution: 0.00001 percent steps.

e. Maximum effective series impedance: R series 3.5 ohms, L series 100 microhenries.

f. Output isolated from the input.

6.4.2 NBS traceability problems for calibrated ac true rms voltmeters. The amplifier input voltage range of 50 to 500 microvolts rms creates NBS traceability problems for calibrated ac true rms voltmeters. Many multimeter and true rms voltmeters have unwarranted claims as to an ac true microvoltage measuring capability. On the lowest range scale, the instruments do not maintain the measurement nor calibration accuracy that is true at higher range scales. The instrument specification sheet itself is often unclear as to the actual accuracy when measuring a microvolts signal. The attenuation circuit as shown in figure 8 of MIL-DTL-22442/1 can resolve this problem without the use of an expensive ac true rms microvoltmeter provided the following conditions are met:

a. The attenuation value is calibrated with NBS traceability at measurable voltage levels.

b. The impedance's do match between the function generator and the amplifier under test.

c. The attenuation value is 80 dB and not 60 dB.

Note: experimental evidence shows that a 60 dB attenuator does not provide a constant voltage independent of frequency or anticipated load impedance's.

An ac ratio transformer standard (see 6.4.1.9), whose ratio is calibrated at a higher voltage level, can serve as an adequate transfer standard for verifying an instrument with ac true rms microvoltage measuring capability and for calibrating the attenuator described in figure 8.

6.5 Definitions.

a. Bend relief. Any method used to alleviate stress on a section of cable due to bending of the cable. Examples: Adding rubber at the cable/connector interface to reduce cable stress caused by movement of the connector.

b. Bonded bend relief. A bend relief which is molded to the connector.

c. Bonded strain relief. A strain relief which is molded to the cable assembly.

d. "Y" junction/crotch. The point at which one cable separates into two or more branches.

e. Heat shrunken transition. Placing a piece of heat shrinkable tubing around a portion of cable and shrinking in place, creating a heat shrunken transition. This is usually placed around an interface where the connector meets the cable.

f. Molded junction. Encapsulating in rubber a junction of one or more cables, or wires, creates a molded junction.

g. Molded section. A molded section is created by encapsulating a portion of the cable jacket in rubber. This differs from the molded junction in that it is not limited to cable junctions.

h. Potted connector. A connector which is sealed by using a potting or encapsulating compound on the backside.

6.6 Part or identifying numbers (PIN). Part numbers for cable assemblies should be constructed as follows: M22442/X-Y with "X" being the specification sheet number and "Y" being any type cable assembly on a specific specification sheet.

6.7 Subject term (key word) listing.

Audio cable
Cord sets
Intercom cable

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army – CR
Navy – AS
Air Force - 85

Preparing activity:
Navy - AS
(Project 5995-2009-001)

Review Activities:
Air Force - 99
DLA - CC
DLA – GS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.